Remarks/Arguments

Claim Summary

Claims 1, 3, 4, 9, 11, 13, 15, 16, 21, 23, 25, 26, 28, 34, 36, 38, 40, 46, 48 and 50 are amended. Claims 22, 29, 35, and 47 are cancelled. New claims 52-53 are added.

Claims 1-21, 23-28, 30-34, 36-46, and 48-53 are pending in the application.

Claim Rejections - 35 USC § 103(a)

Claims 1-21, 23-28, 30-34, and 36-51 were rejected under §103(a) as being unpatentable over Chen et al. in view of Ku et al. (US 6,329,276).

As detailed on pages 4-5 of the Office Action, the Examiner alleges that Chen et al. discloses all the features of claim except:

> "Ku et al discloses the formation of cobalt-containing film is being formed at a temperature of about 400-600 oC (within the temperature range as cited in present application) at which cobalt of the cobalt-containing film and silicon of the silicon-containing conductive region react with each other to form a diffusion restraint interface film made of cobalt monosilicide (lines 65-67, Col.3; lines 1-2, Col. 4). It would have been obvious to one having ordinary skill in the art that cobalt-containing film is formed at a temperature of about 300-500 oC

because the cobalt reacts with silicon at the above temperature to form a diffusion restraint interlace film made of cobalt monosilicide." (Emphasis added.)

Without acquiescing to the Examiner's application of Chen et al. against the present claims, the Applicants respectfully disagree with the Examiner's understanding and reading of the Ku et al. reference.

With reference to FIG. 5, Ku et al. discloses the following steps: (1) a substrate is wet-cleaned; (2) a cobalt layer is formed on the substrate; (3) a capping layer is formed on the first cobalt layer; (4) a cobalt monosilicide layer is formed by annealing at temperature of 400-600°C. Column 3, line 57 to column 4, line 1.

With all due respect, the Examiner appears to be of the opinion that the cobalt monsilicide layer (column 3, line 66) is the same element as the cobalt layer (column 3, line 57). They are not. The cobalt layer is reference numeral 112 and the cobalt monosilicide layer is reference numerals 116 and 118. Column 4, line 43, and line 57. The cobalt monosilicide layer is a layer that is formed after a reaction between silicon and cobalt during an annealing process. This process is generally known as silicidation.

Therefore, the Ku et al. reference discloses annealing cobalt layer 112 at 400-600°C, *not forming a **cobalt layer** at that temperature.*

Applicants submit there is a significant difference between annealing at a temperature a *previously formed* cobalt layer (Ku et al.) verses forming a cobalt layer at a temperature for the first time (present invention).

Further, independent claims 1, 13, 25, 26, 38, and 50 have been amended to better distinguish the present invention over the cited references. Specifically, the independent claims now recite that a diffusion restraint interface film is *interposed* between a cobalt containing layer and a substrate.

In *arguendo,* even if the cobalt monosilicide layer of Ku et al. is analogous to the diffusion restraint interface film of the present invention, the methods of the present application recite forming (1) a cobalt layer on a substrate at a temperature to form a diffusion restraint interface film; (2) forming a capping layer; and (3) an annealing step. In other words, substrate + cobalt monosilicide layer + cobalt layer + capping layer.

To sum up, Ku et al. discloses forming a cobalt monosilicide layer at a different point in a manufacturing process then in the present invention. In addition, Ku et al. discloses forming *a second capping layer on the cobalt monosilicide layer*. The present invention discloses forming *a cobalt containing layer on the diffusion restraint interface film.*

A combination of Chen et al. and Ku et al. fail to disclose forming at sufficient temperature a diffusion restraint interface film by forming a cobalt layer on a substrate. Chen et al. and Ku et al. also fail to disclose forming a cobalt layer on the diffusion restraint interface film.

For at least the reasons stated above, the Applicants believe that the present claims are patentable over Chen et al. and Ku et al. individually or in combination.

Conclusion

No other issues remain, reconsideration and favorable action upon claims 1-21, 23-28, 30-34, 36-46, and 48-53 present in the application are requested.

Respectfully submitted,

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